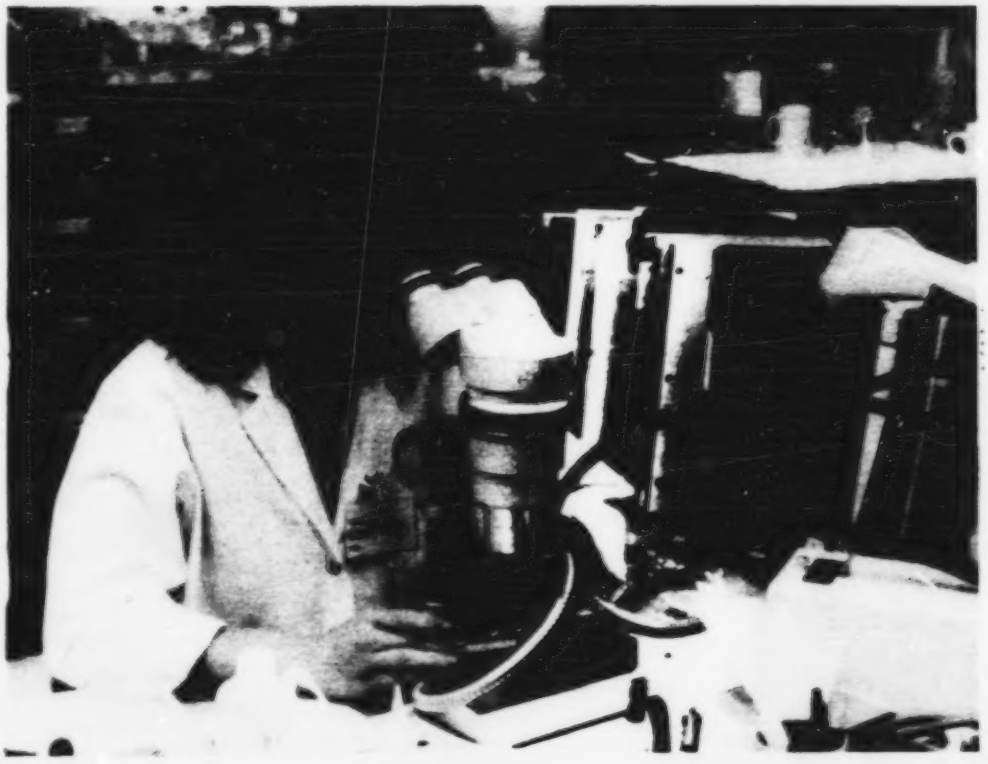
Forestry Canada / Forêts Canada
Ontario Region / Région de l'Ontario

SURVEY BULLETIN

Forest Insect and Disease Conditions in Ontario Summer 1990



Identification Officer K.L. Nystrom examines one of approximately 5000 collections identified by the FIDS diagnostic unit each year.

Canada

FOREST INSECT AND DISEASE CONDITIONS IN ONTARIO

Summer 1990

This is the second of three bulletins describing pest conditions in Ontario forests in 1990.

FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The area affected by spruce budworm in Ontario in 1990 increased for the second consecutive year. Province-wide, 6,780,446 ha of moderate-to-severe defoliation were mapped by aerial and ground surveys (Fig. 1). This represents an increase of 540,810 ha over the 6,239,636 ha recorded last year (Table 1). It should be noted that these figures, and others presented in this report, represent gross areas within which defoliation occurred. They are subject to change should ongoing surveys disclose additional information on the status of various pests.

Most of the defoliation again occurred in the Northwestern and North Central regions, but a new area of 6,392 ha was mapped in Hearst District of Northern Region and single small plantations in the Central and Southwestern regions sustained moderate-to-severe defoliation. In Northwestern Region, the overall area affected declined by about 457,000 ha. In this region, slight increases that occurred along the northern periphery of the infestation, mainly in Red Lake District, were more than offset by moderate decreases in the Ignace, Dryden, Kenora and Sioux Lookout districts and a major decline in the area affected in Fort Frances District.

In North Central Region, a moderate decrease in Atikokan District was overwhelmed by large increases in the area affected in the Thunder Bay, Nipigon, Geraldton and Terrace Bay districts. The main outbreak is again composed of two very large infestations with numerous small pockets along the northern edge and a few along the southern edge. The first large infestation stretches from the Manitoba border eastward through parts of the Kenora, Fort Frances, Dryden, Red Lake, Sioux Lookout, Ignace and Atikokan districts to the Shabaqua-Raith area of southwestern Thunder Bay District, encompassing an area of approximately 3,079,700 ha. It is separated from the second infestation by a narrow budworm-free corridor; this infestation covered approximately 3,093,000 ha, from the Graham-Thunder Bay area of Thunder Bay District through Nipigon District to the Manitouwadge-Stevens area in the Terrace Bay and Geraldton districts. This infestation included most of the islands in Lake Nipigon as well as most of the islands along the northwestern coast of Lake Superior.

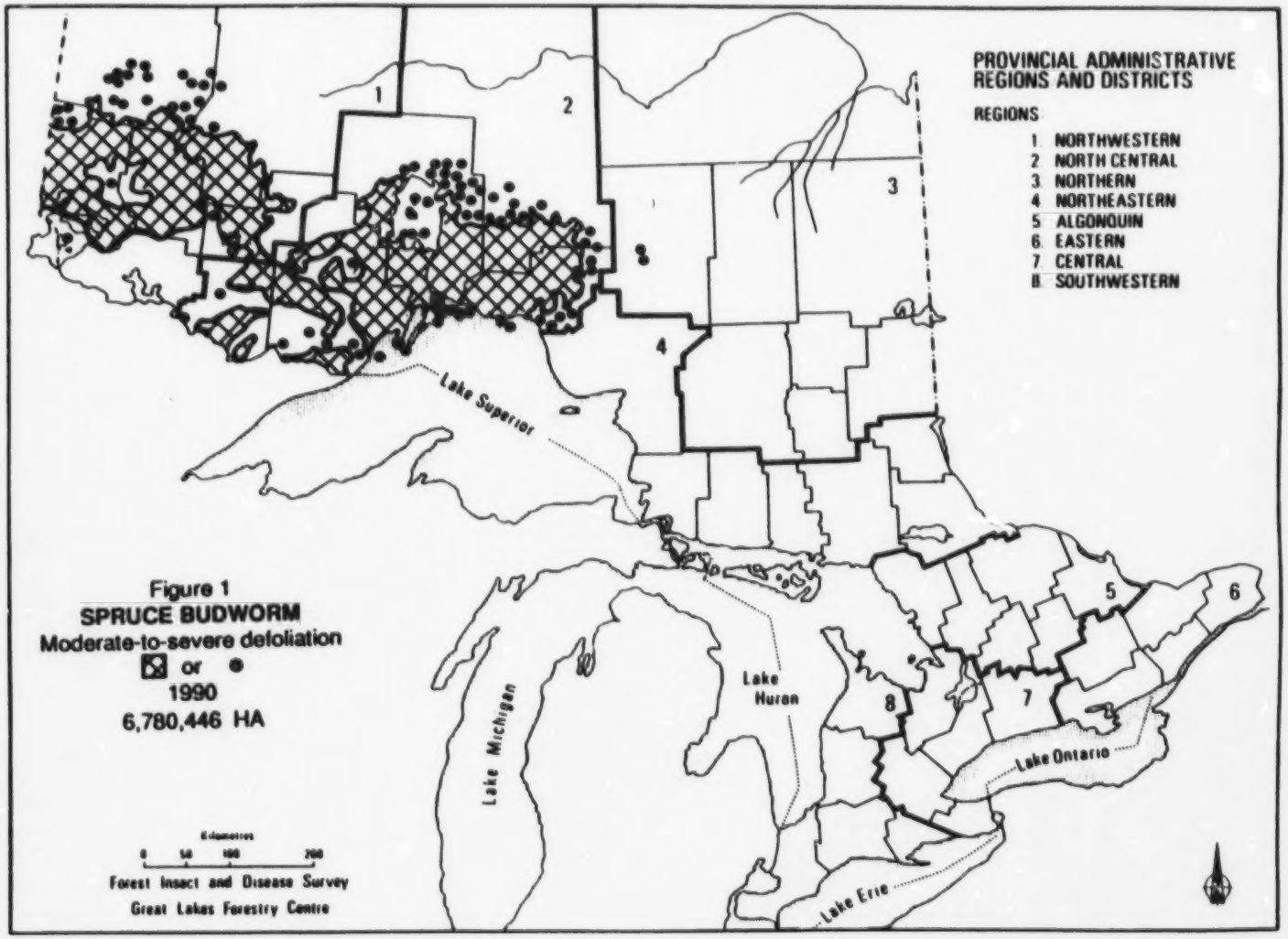

PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 1
SPRUCE BUDWORM
Moderate-to-severe defoliation
or
1990
6,780,446 HA
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 1. Gross area (ha) of current moderate-to-severe defoliation by spruce budworm in Ontario from 1988 to 1990.

Region / District	Area of moderate-to-severe defoliation (ha) 1988	1989	1990
North Central			
Atikokan	578,464	482,208	410,377
Thunder Bay	376,395	597,382	1,273,723
Nipigon	605,741	940,513	1,087,868
Terrace Bay	260,393	624,724	761,251
Geraldton	13,956	389,750	493,011
	1,834,949	3,034,577	4,026,230
Northwestern			
Ignace	512,961	419,620	314,071
Dryden	907,685	902,750	815,547
Sioux Lookout	540,334	586,772	523,344
Fort Frances	275,817	199,084	6,720
Kenora	886,627	897,779	859,395
Red Lake	266,361	199,054	228,747
	3,389,785	3,205,059	2,747,824
Northern			
Chapleau	0	0	0
Cochrane	0	0	0
Gogama	0	0	0
Hearst	0	0	6,392
Kapuskasing	0	0	0
Kirkland Lake	0	0	
	0	0	6,392
Northeastern			
Blind River	0	0	0
Espanola	0	0	0
North Bay	0	0	0
Sault Ste. Marie	0	0	0
Sudbury	0	0	0
Temagami	0	0	0
Wawa	0	0	0
	0	0	0
Total	5,224,734	6,239,636	6,780,446

Three sizeable infestations were mapped along the American border in the Atikokan and Thunder Bay districts. These were located in the Lac la Croix-Pickerel Lake-Argo Lake area (186,779 ha), in the Bayley Bay-Agnes Lake area (44,083 ha), and in the Gunflint Lake-Silver Mountain-Horne Falls area (88,083 ha). The infestation in Hearst District occurred around the western end of Nagagami Lake, including parts of Frost and McEwing townships, and the western end of Nagagamisis Provincial Park. Infestations in southern Ontario included an 18-ha white spruce (*Picea glauca* [Moench] Voss) plantation in Wingham District, a 7-ha white spruce plantation in Huronia District and a 5-ha white spruce plantation in Maple District.

Increased but still low population levels were reported from a number of areas in Chapleau District and from two locations in North Bay District.

Spruce budworm egg-mass surveys are currently under way and these will be used to forecast 1991 population trends for this major pest. Results of these surveys will be presented in the fall Survey Bulletin.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

A substantial increase in populations of this insect occurred in 1990 for the fourth consecutive year. Aerial and ground surveys disclosed a total area of 9,480,408 ha of moderate-to-severe defoliation, up from 7,915,111 ha in 1989. Declines in the area affected were recorded in the southern and eastern parts of the outbreak, namely the Algonquin, Eastern, Central and Northeastern regions, but these were more than offset by large increases in the Northern, North Central and Northwestern regions (Table 2, Fig. 2).

The largest infestation occurred in northwestern Ontario, stretching from the Manitoba border eastward through large areas of the Fort Frances, Kenora, Dryden, Sioux Lookout and Ignace districts to west-central Thunder Bay District, including approximately 4,867,000 ha of moderate-to-severe defoliation. A number of scattered pockets of damage, ranging from 225 to 11,798 ha in size, occurred along the northern periphery of the infestation in the southern portion of the Sioux Lookout and Red Lake districts and the northern portion of the Kenora, Dryden and Ignace districts. Two large pockets of damage occurred in southwestern Atikokan District, centered on Kawnipi Lake (25,250 ha) and Sunday Lake (17,224 ha). Numerous patches of infestation were mapped in Thunder Bay District and along the western side of Lake Nipigon in Nipigon District. The largest of these, 61,816 ha in area, straddled the Thunder Bay-Ignace district boundary in the vicinity of Metionga Lake. A large infestation, 101,640 ha in area, surrounded by numerous small pockets of damage occurred on the eastern side of Lake Nipigon in the Beardmore-Jellicoe area of Nipigon District. Scattered pockets of moderate-to-severe defoliation were mapped across southern

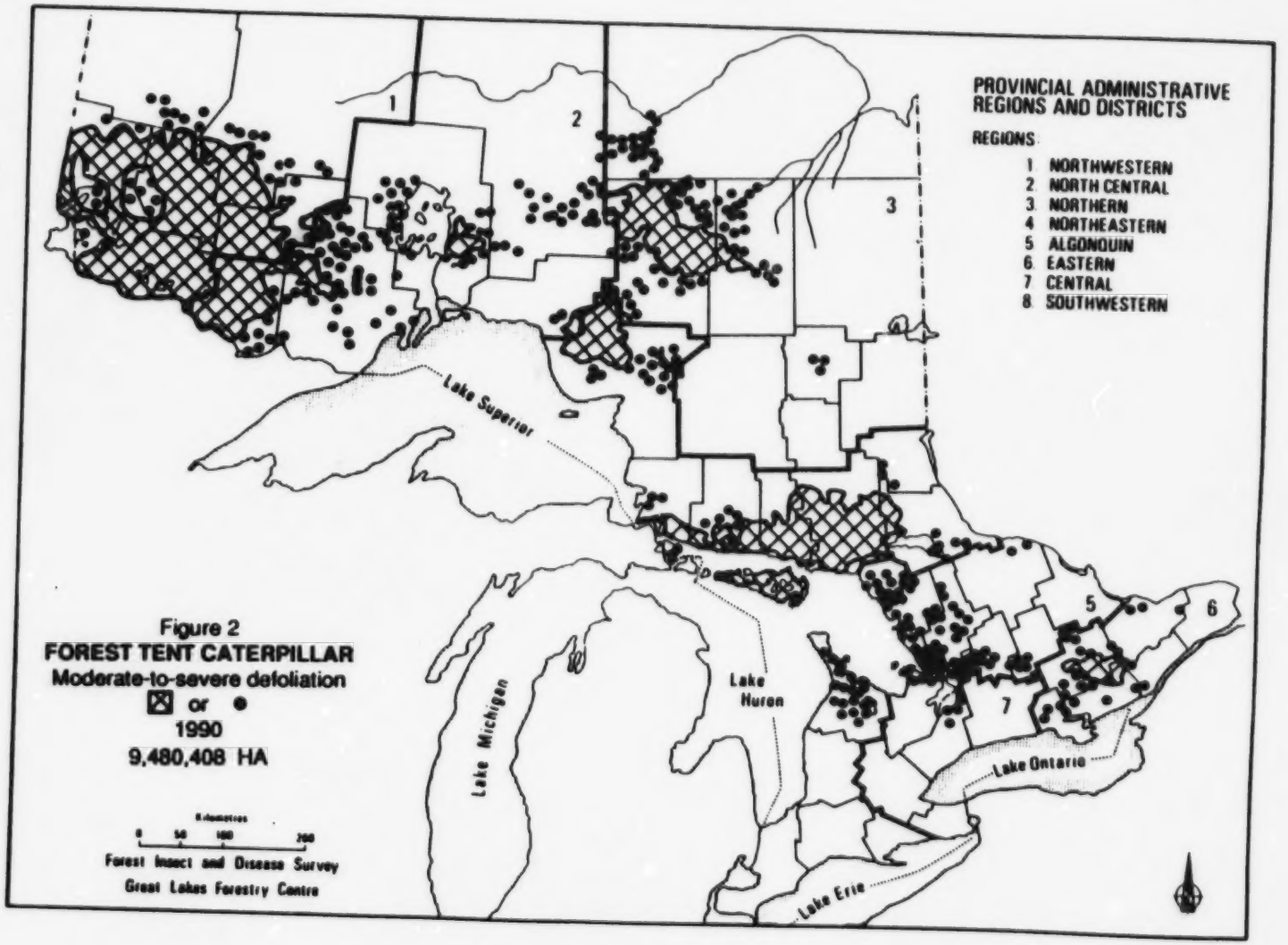
Table 2. Gross area of current moderate-to-severe defoliation by the forest tent caterpillar in Ontario from 1986 to 1990.

Region / District	Area of moderate-to-severe defoliation (ha)				
	1986	1987	1988	1989	1990
Northwestern					
Red Lake	0	0	0	0	37,954
Ignace	0	0	0	12,403	577,960
Sioux Lookout	0	0	0	450	436,703
Dryden	0	0	610	564,902	974,160
Fort Frances	0	5,025	257,305	1,048,876	1,080,680
Kenora	0	0	15,070	553,487	965,400
	0	5,025	272,985	2,180,118	4,072,857
North Central					
Geraldton	0	0	0	180	74,730
Atikokan	0	1,770	28,160	423,404	816,998
Thunder Bay	250	280	4,230	19,739	310,307
Nipigon	0	0	560	8,535	176,686
Terrace Bay	0	380	690	4,255	35,065
	250	2,430	33,640	456,113	1,413,786
Northeastern					
Wawa	14,335	10,720	12,087	80,143	499,697
Sault Ste. Marie	0	11,340	26,560	116,107	102,669
Blind River	4,940	35,867	102,852	208,878	200,445
Espanola	5,230	67,010	415,273	615,345	657,717
Sudbury	0	39,394	442,274	843,409	849,127
Temagami	163,540	292,913	252,650	160,770	330
North Bay	86,920	584,501	856,053	1,031,622	145,570
	274,965	1,041,745	2,107,749	3,056,274	2,455,555
Northern					
Kapuskasing	0	0	0	7,482	85,981
Hearst	0	0	10,550	150,438	789,396
Kirkland Lake	123,280	112,452	0	0	0
Gogama	21,370	0	0	0	0
Timmins	0	0	0	0	170
Moosonee	0	0	0	0	46,446
Chapleau	1,975	460	0	300	0
	146,625	112,912	10,550	158,220	921,993

(cont'd)

Table 2. Gross area of current moderate-to-severe defoliation by the forest tent caterpillar in Ontario from 1986 to 1990 (concl.).

Region / District	Area of moderate-to-severe defoliation (ha)				
	1986	1987	1988	1989	1990
Algonquin					
Bancroft	0	28,628	148,125	212,540	260
Minden	0	53,653	268,633	267,576	49,675
Parry Sound	11,160	241,399	408,302	390,886	102,714
Bracebridge	0	150,104	330,845	174,171	39,106
Algonquin Park	0	0	62,579	171,988	330
Pembroke	0	180	39,425	102,795	85
	11,160	473,964	1,257,909	1,319,956	192,170
Eastern					
Brockville	0	0	0	720	22,020
Cornwall	0	0	445	0	0
Carleton Place	0	78	3,835	11,847	14,367
Tweed	0	902	121,174	345,104	215,441
Napanee	0	0	190	81.248	78,479
	0	980	125,644	438,919	330,307
Central					
Maple	0	0	0	2,130	1,335
Lindsay	0	5,198	47,752	132,578	350
Huronia	0	7,723	104,240	124,513	29,166
	0	12,921	151,992	259,221	30,851
Southwestern					
Owen Sound	0	0	4,760	46,290	62,889
	0	0	4,760	46,290	62,889
Total	433,000	1,649,977	3,965,229	7,915,111	9,480,408


PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS
1 NORTHWESTERN
2 NORTH CENTRAL
3 NORTHERN
4 NORTHEASTERN
5 ALGONQUIN
6 EASTERN
7 CENTRAL
8 SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 2
FOREST TENT CATERPILLAR
Moderate-to-severe defoliation
or
1990
9,480,408 HA
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Geraldton District, the largest of which occurred in Chipman and Goodman townships (8,586 ha) and near Prairie Lake (8,518 ha). A major infestation occupied some 715,412 ha in Hearst District, with small extensions east to the Opasatika area of Kapuskasing District and west to the Pagwa area of Geraldton District. The infestation also extended north into Moosonee District in narrow bands along the Kenogami and Albany rivers and their tributaries. Defoliation was mapped as far north as Albany Forks; however, time and logistics did not permit completion of aerial surveys along these northern rivers. A large number of smaller patches of defoliation surrounded the above area, the largest of which occupied 10,794 ha in the Amery-Burstall townships area of Kapuskasing District. Another major infestation was mapped in northwestern Wawa District. This infestation encompassed 517,087 ha in the Hemlo-White River-Amyot area, with small extensions north and west into the adjacent Hearst and Terrace Bay districts. Three other infestations were also mapped in Wawa District in the vicinities of Franz (8,484 ha) and Missinaibi (11,041 ha) and west of Dubreuilville (18,485 ha).

In the central part of the province, heavy infestations persisted from the vicinity of Sault Ste. Marie eastward through the southern portions of the Sault Ste. Marie, Blind River, Espanola and Sudbury districts to the area of Sturgeon Falls in western North Bay District. An area of approximately 1,903,400 ha was encompassed. The above area also included large sections of Manitoulin, St. Joseph and other small islands in the North Channel of Lake Huron. A sizeable (31,284 ha) but discrete infestation was mapped in the southern part of North Bay District, south of the town of Callander and centered on North Himsworth Township. Infestations have collapsed in eastern, central and northern North Bay District as well as in Temagami District. These declines were expected, as this was the oldest part of the current outbreak.

The large infestation in southern Ontario broke up into a few large pockets and numerous smaller ones. This pattern was most evident in Parry Sound District and in western Bracebridge District. Here, the largest patches were located east of the Georgian Bay coastline in the Grundy Lake-Sturgeon Bay area (27,260 ha), the Shawanaga area (16,716 ha) and in the McKenzie Township area (20,987 ha). Two large pockets of damage and a number of small ones persisted near the junction of the corners of the Huronia, Parry Sound, Bracebridge and Minden districts. These were located in the Gibson River-Matchedash Township area (32,366 ha) and in the Gravenhurst-Lutterworth Township area (65,154 ha). A third sizeable pocket (6,982 ha) occurred in the Six Mile Lake-Port Severn area of Huronia District. Infestations increased in Owen Sound District, where numerous patches of moderate-to-severe defoliation were mapped between Bentinck Township and Barrow Bay on the Bruce Peninsula. The largest of these covered some 25,725 ha of predominantly sugar maple (*Acer saccharum* Marsh.) stands in the Albemarle Township-Cape Croker area. Other sizeable pockets of damage were located near Shallow Lake (5,723 ha), in Sydenham Township (4,468 ha) and in the Walters Falls-Lily Oak area (10,545 ha). The largest infestation in southern Ontario, some 341,405 ha in extent, was mapped in southern Tweed District, with extensions into adjacent areas of the Carleton Place, Brockville and Napanee districts. Numerous, very small

pockets of moderate-to-severe defoliation were recorded in western Napanee District and a 4,600-ha infestation occurred in Burleigh and Anstruther townships, Bancroft District.

Egg-band counts will be carried out in the latter part of the field season in order to predict the course of the forest tent caterpillar outbreak in 1991.

Gypsy Moth, *Lymantria dispar* (L.)

There was an overall decline in the area affected by gypsy moth in 1990. Province-wide, 75,323 ha of moderate-to-severe defoliation were recorded, compared with 81,640 ha in 1989 (Table 3). Most of the decline occurred in Eastern Region (Tables 4 and 5), where large infestations in the Brockville, Tweed, Carleton Place and Napanee districts broke up into numerous small pockets (Fig. 3). These declines were somewhat offset by substantial increases in the area affected in Algonquin Region, with a major increase in Bancroft District and smaller increases in the Bracebridge, Parry Sound and Pembroke districts. A major increase occurred in Niagara District of Central Region and substantial but somewhat smaller increases were also recorded in the Cambridge, Huronia and Maple districts. The largest infestations occurred throughout Niagara District, where some 19,474 ha of moderate-to-severe defoliation were mapped. This occurred in scattered pockets ranging in size from a few to 1,650 ha, mostly in hardwood woodlots with a high oak (*Quercus* spp.) content. This pattern of infestation occurred across the entire southern portion of Niagara District and extended into southern Cambridge District in the vicinity of the Six Nations Reserve south of Brantford. Scattered pockets of medium-to-heavy infestations were more widespread in southwestern Simcoe District than in 1989, but the total area affected was somewhat lower this year.

Infestations in Maple District consisted of several pockets in the central part of the district and those in Huronia District were composed of one large pocket near Barrie and several in the Midland-Penetanguishene area, including Christian Island in Georgian Bay. In Parry Sound District, the largest infestation (5,234 ha) occurred near MacTier, in Freeman Township, with a second large pocket of damage (2,500 ha) west of the town of Parry Sound in the Parry Island Indian Reserve. Most of the defoliation in Bracebridge District was mapped in the Lake Rosseau-Lake Muskoka area, with the two largest infestations located at the south end of Lake Muskoka near the town of Gravenhurst (1,775 ha) and west of Glen Orchard (1,328 ha). The largest infestation in Minden District was located on the southwestern side of Gull Lake, where a 1,350-ha pocket of damage was surrounded by a number of smaller patches of defoliation. Most of the infestations in Lindsay District occurred in a cluster of small pockets of damage on the southern side of Rice Lake in the Gore Landing-Halstead Beach area and in a number of widely scattered pockets east of Peterborough. The largest infestation in Bancroft District was located mainly in Burleigh Township, where 11,264 ha of moderate-to-severe defoliation were mapped between Anstruther and Big Cedar lakes.

Table 3. Gypsy moth infestations in Ontario, 1981-1990.

Year of infestation	Gross area of moderate-to-severe defoliation (ha)
1981	1,450
1982	4,800
1983	40,954
1984	80,624
1985	246,342
1986	167,776
1987	12,678
1988	29,693
1989	81,640
1990	77,648

Table 4. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth in Ontario, 1986-1990.

Region	District	1986	1987	1988	1989	1990
Eastern	Tweed	73,525	3,329	16,089	39,096	1,259
	Napanee	57,780	4,781	6,198	15,001	4,086
	Carleton Place	13,386	1,355	3,918	2,634	143
	Brockville	22,283	2,099	1,865	12,250	395
		166,974	11,564	28,070	68,981	5,883
Algonquin	Algonquin Park	0	0	0	0	172
	Bracebridge	0	0	0	0	4,359
	Pembroke	221	0	124	1,154	7,148
	Bancroft	164	111	370	15	13,133
	Minden	0	0	0	65	5,056
	Parry Sound	0	0	0	0	9,367
		385	111	494	1,234	39,235
Central	Cambridge	0	0	0	0	3,323
	Huronia	0	0	0	0	2,418
	Lindsay	417	888	861	4,071	1,118
	Niagara	0	0	28	2,177	19,474
	Maple	0	0	0	370	2,291
		417	888	889	6,618	28,624
Southwestern	Aylmer	0	0	0	0	30
	Chatham	0	0	0	0	20
	Simcoe	0	115	240	4,807	3,856
		0	115	240	4,807	3,906
Total		167,776	12,678	29,693	81,640	77,648

Infestations in Pembroke District consisted of several large pockets in the Round Lake-Golden Lake area and numerous small pockets in Jones, Radcliffe, Richards, Fraser, Petawawa and Wilberforce townships.

Table 5. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth, 1986-1990.

Locality	Year				
	1986	1987	1988	1989	1990
Brant[a]	0	0	0	0	2,574
Durham[b]	0	118	51	50	567
Elgin[a]	0	0	0	0	30
Frontenac[a]	109,442	1,775	1,861	11,625	3,234
Haldimand-Norfolk[b]	0	115	240	4,937	12,061
Haliburton[a]	0	0	0	0	4,187
Halton[b]	0	0	0	0	397
Hamilton-Wentworth[b]	0	0	0	0	352
Hastings[a]	11,668	4,511	5,625	22,262	806
Lambton[a]	0	0	0	0	20
Lanark[a]	13,356	1,355	3,918	2,590	143
Leeds and Grenville[a]	22,283	2,099	1,865	12,250	395
Lennox and Addington[a]	8,627	407	10,007	12,660	905
Muskoka[b]	0	0	0	0	10,137
Niagara[b]	0	0	28	2,047	11,269
Nipissing District	0	0	0	0	172
Northumberland[a]	1,430	2,131	5,341	8,231	607
Ottawa-Carleton[b]	221	0	0	44	0
Parry Sound District	0	0	0	0	3,589
Peterborough[a]	179	167	565	3,045	14,554
Prince Edward[a]	540	0	0	340	74
Renfrew[a]	0	0	124	1,154	7,148
Simcoe[a]	0	0	0	0	2,418
Victoria[a]	0	0	68	35	123
York[b]	0	0	0	370	1,886
Total	167,776	12,678	29,693	81,640	77,648

[a] county
[b] regional municipality

Gypsy moth larvae were observed causing light and occasionally moderate defoliation at many other locations in southern Ontario as well as at several locations on Manitoulin Island, at the McBean Harbour Junior Ranger Camp in Espanola District, and at Killarney Provincial Park, Sudbury District, Northeastern Region.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

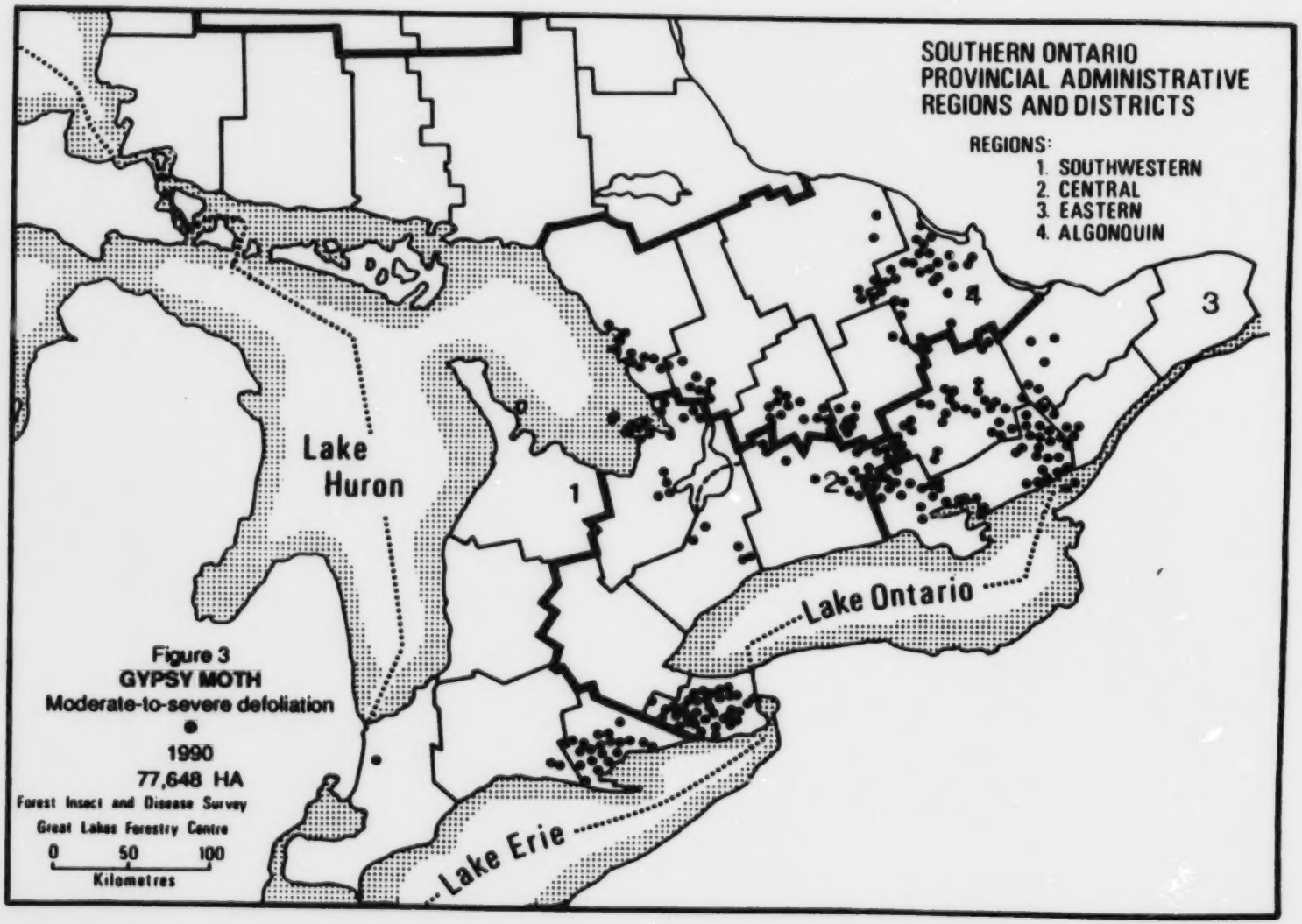
Heavy infestations by the jack pine budworm were mapped in Parry Sound District of Algonquin Region. In all, some 29,660 ha of moderate-to-severe defoliation were mapped east of Georgian Bay between Charles Inlet and the southern boundary of the Henvey Inlet Indian Reserve. The area of defoliation extends inland from the coast to the eastern boundary of the Magnetawan Indian Reserve and through the center of Wallbridge and Harrison townships between the Still River and Gordon Lake. The infestation is unusual in that it has been only 3 years since the last jack pine budworm outbreak, which lasted from 1983 to 1986, subsided in the area. The jack pine (*Pinus banksiana* Lamb.) in the area is under extreme stress since it was subjected to heavy defoliation during the last jack pine budworm outbreak, followed by drought conditions in 1988 and 1989. Renewed jack pine budworm defoliation is further exacerbated this year because most trees in the area are growing on poor sites.

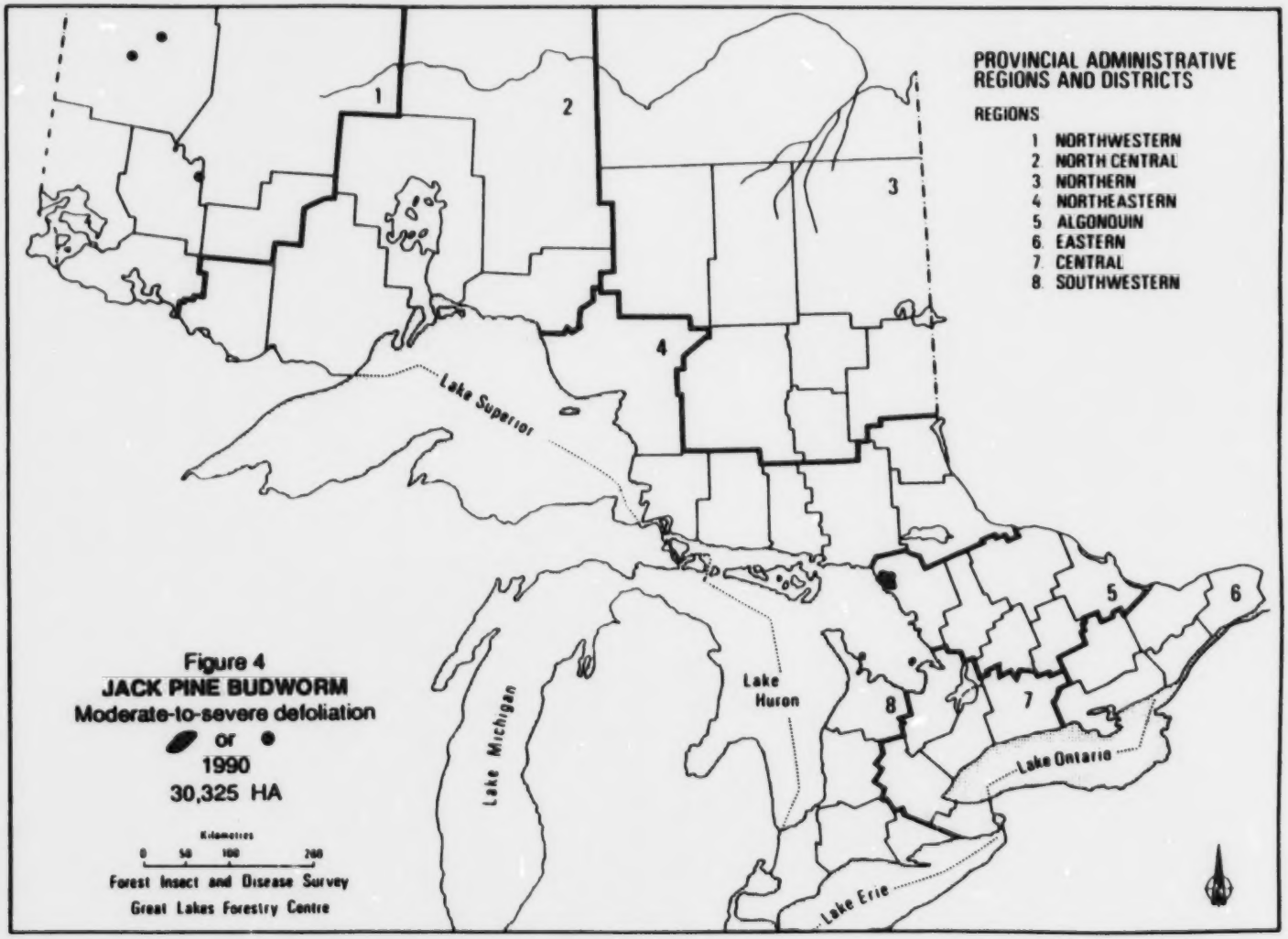
Elsewhere in the province (Fig. 4), infestations that defoliated some 248,311 ha in the Red Lake and Sioux Lookout districts in 1989 subsided this year. Moderate defoliation persisted in two small pockets in Red Lake District, totaling 655 ha, and in one small area of about 10 ha in Sioux Lookout District. Small numbers of larvae were collected at single locations in Ledger Township, Nipigon District, and McEwing Township, Hearst District.

Pine False Webworm, *Acantholyda erythrocephala* L.

High population levels were present in many red pine (*Pinus resinosa* Ait.) and white pine (*P. strobus* L.) plantations in Algonquin Region. The most severe damage was recorded in a 14-ha plantation of 3.4-m red pine in McMurrich Township, Parry Sound District, in which 100% of the trees were attacked and an average of 86% of the old foliage and about 25% of the new foliage were destroyed. Medium-to-heavy damage occurred in a number of other plantations in the Bracebridge, Minden, Parry Sound, Algonquin Park, Bancroft and Pembroke districts. The proportion of trees attacked in these areas ranged from 52 to 97% and average foliar damage ranged from 6 to 45%. In many cases, individual trees sustained defoliation in excess of 90%. A number of plantations in the Minden and Parry Sound districts were treated by the Ontario Ministry of Natural Resources (OMNR) with the insecticide Sevin to control populations and limit defoliation.

Although increased population levels were noted at a number of locations in Eastern Region, average defoliation was usually less than 10%. A single exception occurred in Fitzroy Township, Carleton Place District, where 60% of the trees sustained an average of 25% defoliation. In Central Region, a 5-ha, 1.7-m red pine plantation in Manvers Township, Lindsay District, had 79% of the trees infested with an average of 23% defoliation; however, some individual trees at this location sustained 100% defoliation. Light-to-moderate defoliation was reported on white pine trees in the Glencairn seed orchard in Huronia District of the same region. Medium populations in a 5-ha Scots pine Christmas tree plantation in Owen Sound District of Southwestern


SOUTHERN ONTARIO
PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS:
1. SOUTHWESTERN
2. CENTRAL
3. EASTERN
4. ALGONQUIN
Lake Huron
Lake Ontario
Lake Erie
1
2
3
4
Figure 3
GYPSY MOTH
Moderate-to-severe defoliation
1990
77,648 HA
Forest Insect and Disease Survey
Great Lakes Forestry Centre
0 50 100
Kilometres


PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS
1 NORTHWESTERN
2 NORTH CENTRAL
3 NORTHERN
4 NORTHEASTERN
5 ALGONQUIN
6 EASTERN
7 CENTRAL
8 SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 4
JACK PINE BUDWORM
Moderate-to-severe defoliation
or
1990
30,325 HA
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

Region required control measures to limit damage. The insect was found commonly on ornamental pines at a number of locations in the city of Sault Ste. Marie.

Fall Cankerworm, *Alsophila pometaria* (Harr.)

For the third consecutive year, a heavy infestation of this early-season pest caused >75% defoliation of ornamental Manitoba maple (*Acer negundo* L.) in the town of Sioux Lookout. Defoliation ranging from 26 to 100% was recorded on the same host in the towns of Fort Frances and Kenora. Somewhat lighter damage, in the 40% range, was reported on a few white elm (*Ulmus americana* L.) and Manitoba maple in the city of Thunder Bay.

Cedar Leaf Miners, *Argyresthia aureoargentella* Brower, *A. canadensis* Free., *A. thuiella* (Pack) and *Coleotechnites thujaella* (Kft.)

Heavy infestations by this complex of insects caused severe browning of cedar (*Thuja* spp.) stands within a total area of some 554,310 ha in Eastern Region. Most of this area was located within the Carleton Place and Brockville districts, in a large block that stretched north from the Brockville-Iroquois area on the northern shore of the St. Lawrence to the Lanark-Ramsay townships area. Other sizeable pockets of damage occurred north of Brighton in western Napanee District, and in Tudor, Cashel and Huntingdon townships, Tweed District. Within these areas, repeated defoliation, combined with other stress factors such as drought, has caused sporadic top killing ranging from 1 to 10% and occasional whole-tree mortality.

Elsewhere in the province, foliar damage in the 75-100% range was recorded in Uxbridge and Pickering townships in the southeastern corner of Maple District. Defoliation levels ranged from 10 to 20% in the remainder of Maple District as well as in the Huronia, Cambridge and Owen Sound districts. Some stands in Eastnor and Bentinck townships, Owen Sound District, sustained foliar browning in the 50-60% range. Light cedar leafminer damage, combined with winter drying and infestations of spruce spider mite (*Oligonychus ununguis* [Jac.]), caused 25 to 35% foliar damage to cedar at the Orono Forest Tree Nursery, Lindsay District. Leafminer populations were reported to be generally low throughout Southwestern Region and on Manitoulin Island in Espanola District.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)

An infestation of this pest that has occurred for the past several years in the Hays Lake area of Terrace Bay District declined to low levels in 1990, with defoliation of about 10%. Small numbers of this pest were encountered at numerous other locations in Terrace Bay District as well as in the Nipigon and Wawa districts, but populations have generally declined to endemic levels across most of the province.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Populations of this spring defoliator increased and were widely distributed in southern Ontario and to a lesser extent in Northeastern Region. Probably the largest and most severe area of damage occurred in the Minesing Swamp in Vespra Township, Huronia District, where a tamarack (*Larix laricina* [Du Roi] K. Koch) stand about 100 ha in size was almost completely defoliated. Numerous small European larch (*L. decidua* Mill.) plantations and tamarack stands sustained defoliation ranging from 50 to 100% in the Huronia, Cambridge, Aylmer, Simcoe and Niagara districts. Similar damage levels were also reported in small tamarack stands and occasional European and Japanese larch (*L. leptolepis* [Sieb. & Zucc.] Gord.) plantations in the Bracebridge, Lindsay, Minden, Carleton Place, Brockville and Cornwall districts. Infestations were more sporadic in Northeastern Region, with defoliation ranging from 40 to 80% recorded in a number of tamarack stands in the Espanola, North Bay, Blind River and Sault Ste. Marie districts. Low population levels were reported from several areas in central Chapleau District.

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)

Population levels of this potentially damaging pest remained very low in Ontario in 1990. The only infestation of any significance occurred in Pelham Township, Niagara District, where defoliation of 20% was recorded in a red oak (*Quercus rubra* L.) stand. Large numbers of larvae were observed in a red oak stand at one location in Thessalon Township, Blind River District; however, the area was heavily infested with forest tent caterpillar, which made it impossible to isolate the effects of oak leaf shredder on the stand. No other reports of the insect were received.

Pine Needleminer, *Exotelia pinifoliella* (Cham.)

Heavy infestations that had occurred in 1989 in Bigwood Township, Sudbury District, and Curtin Township, Espanola District, declined to low levels this year. In Bigwood Township, defoliation of about 5% was recorded in jack pine stands over a 15-ha area; similar defoliation levels were recorded in a 5-ha area in Curtin Township. A new infestation was discovered in MacPherson Township, North Bay District, where about 5 ha of mature jack pine on an open, rocky site sustained 15% defoliation. A new, heavy infestation was also recorded in the city of Sault Ste. Marie, where a small, 1-ha stand of 4-m jack pine and Scots pine (*Pinus sylvestris* L.) sustained foliar damage in the 90% range.

Birch Leafminer, *Fenusa pusilla* (Lep.)

The first generation of this pest caused severe damage to white birch (*Betula papyrifera* Marsh.) foliage in a number of areas in northern Ontario. The most widespread and severe damage to forest stands occurred in Thunder Bay District. Here, defoliation in the 50-100% range was mapped in two areas totaling 60 ha in O'Connor Township and about 40 ha of similar damage along the Pigeon River in Pardee Township. Similar damage occurred in small clumps of white birch in nine other townships in the southwestern corner of Thunder Bay District. Moderate-to-severe foliar browning recurred on single and small clumps of trees in the Highway 11 - Highway 17 corridor in the Red Rock area of Nipigon District. Foliar browning in the 75-100% range was also reported in the Goulais Bay area, in the Searchmont area and in Curtis and Whitman townships of Sault Ste. Marie District, and in adjacent Renwick Township of Blind River District. High population levels were also reported from the Timmins and Kirkland Lake districts, where aerial surveys disclosed numerous pockets of damage, some as large as 2 ha. Damage to ornamentals was apparent in many areas in northern Ontario, but was particularly severe in the city of Sault Ste. Marie and in Greenwater Provincial Park in Cochrane District.

Reports of the insect in southern Ontario were scarce; however, severe browning was reported on ornamentals in many urban areas in the Huronia, Simcoe, Niagara, Wingham, Chatham and Aylmer districts.

American Aspen Beetle, *Gonioctena americana* (Schaeff.)

Increased populations of this spring defoliator of trembling aspen (*Populus tremuloides* Michx.) were reported in the Timmins, Temagami and Kirkland Lake districts. The most severe damage occurred in a 2-ha stand of 12-m overstory trembling aspen and on 2-m understory trees, which sustained approximately 75% defoliation. High population levels also occurred at a number of locations in the Chapleau and Gogama districts, and a medium infestation occurred on 6-m trees near Eaglehead Lake, Thunder Bay District. Generally low population levels were observed at a number of locations in the Terrace Bay, Geraldton and Wawa districts.

Eastern Tent Caterpillar, *Malacosoma americanum* (F.) and Northern Tent Caterpillar, *M. californicum pluviale* (Dyar)

Heavy infestations by the eastern tent caterpillar persisted on roadside and open-grown shrubbery in the Bracebridge, Minden and Parry Sound districts, where defoliation was often near 100%. High population levels also occurred on a variety of hosts at a few locations in the Blind River and Sault Ste. Marie districts and in the southern portions of the Espanola, Sudbury and North Bay districts. Populations declined to generally low levels in the Huronia, Owen Sound, Brockville and Tweed districts.

Population levels of the northern tent caterpillar were high on a variety of deciduous hosts throughout much of the Geraldton, Terrace Bay and Nipigon districts, in the northern half of Atikokan District, and at a few locations in the Thunder Bay, Espanola and North Bay districts. Generally low population levels were evident in the Chapleau and Gogama districts, although large numbers of the pest were reported at several locations in central Chapleau District. Large numbers of caterpillars also occurred in the southern halves of the Red Lake and Sioux Lookout districts.

Balsam Fir Sawfly, *Neodiprion abietis* complex

Heavy infestations caused as much as 60% defoliation in the upper crowns of single and small groups of balsam fir (*Abies balsamea* [L.] Mill.) trees in Silver Lake Provincial Park and Fitzroy Provincial Park, Carleton Place District. Low population levels caused 10% defoliation to balsam fir trees in Cashel Township, Bancroft District, and in Ivanhoe Township, Chapleau District. The insect was also reported in small numbers in Farquhar Township, Hearst District.

Pine Sawflies, *Neodiprion nanulus nanulus* Schedl., *N. pratti banksianae* Roh. and *N. pratti paradoxicus* Ross.

Populations of the jack pine sawfly (*N. pratti paradoxicus*) increased in 1989 and the pest was widespread in Eastern Region. The most severe damage occurred in Brockville District, where small plantations in Elizabethtown and South Gower townships had 98 and 82%, respectively, of the trees infested, with average defoliation of 60% in both areas. Defoliation of about 10% was reported on a small group of open-grown jack pine in Galway Township, Minden District.

The closely related blackheaded jack pine sawfly (*N. pratti banksianae*) was widely distributed in other areas of the province. Feeding damage by this insect, often in conjunction with that of the red pine sawfly (*N. nanulus nanulus*), was most conspicuous in the Thunder Bay, Atikokan, Chapleau and Gogama districts. Defoliation, mainly of fringe and open-grown trees, was approximately 40%, with occasional trees sustaining 90% damage near Huronia and in Fallis Township, Thunder Bay District, and near French, Nym and Perch lakes, Atikokan District. Generally light defoliation by *N. pratti banksianae* was observed at numerous locations in the Sioux Lookout, Ignace and Red Lake districts, as well as at one location in Findlayson Point Provincial Park, Temagami District. Similarly, small numbers of colonies of *N. nanulus nanulus* caused generally light defoliation of jack pine at a few locations in the Temagami, Blind River, Wawa, Hearst, and Sudbury districts and on Scots pine Christmas trees at one location in Cambridge District. The highest population levels occurred in a 5-ha area near Ramsay Lake, Sudbury District, where 2.5-m red pine sustained defoliation ranging from 10 to 20%.

European Pine Sawfly, *Neodiprion sertifer* (Geoff.)

This early defoliator of pines was widely distributed in southern Ontario and was probably most abundant in southern Simcoe District. The insect was found infesting a number of Scots pine Christmas tree plantations in this area and, though the proportion of trees attacked was as high as 80%, prompt control action by growers usually limited defoliation to 10% or less. The control agent most often used was Sevin XLR, but in one case, "sertifer" virus was employed at a rate of 5 mg of active ingredient/20 litres of water/ha. A single Christmas tree plantation in Keppel Township, Owen Sound District, also required control measures to limit defoliation. Low and occasionally medium population levels were reported on various species of plantation, roadside and ornamental pine (*Pinus* spp.) trees in the Aylmer, Chatham, Maple, Huronia, Minden, Lindsay, Brockville, Carleton Place, Sudbury and Sault Ste. Marie districts. A single heavy infestation was reported in a 1-ha Scots pine plantation in Carnarvon Township on Manitoulin Island, Espanola District, where 80% of the old foliage was destroyed.

Northern Pitch Twig Moth, *Petrova albicapitana* (Bsk.)

This insect was found in generally low numbers in many young jack pine stands in the Timmins, Temagami and Kirkland Lake districts. It was also reported in low numbers at several areas in the Hearst and Cochrane districts and from single locations in the Terrace Bay and Wawa districts. In most cases, the level of infestation was less than 10%. An exception occurred in Macklem Township, Timmins District, where 12% of the 2.8-m trees in a 4-ha jack pine plantation were infested, with 6.7% of the trees suffering main-stem attacks. As well, a 25-ha plantation of 1.8-m jack pine in Chelsea Township, Hearst District, had 11.3% of the trees infested.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

Preliminary reports on this insect indicate that heavy infestations are again evident on white spruce snow hedges, windbreaks and trees in other open-grown situations in the Kirkland Lake and Cochrane districts. Similar but less severe damage was also apparent in the Temagami, Timmins, Hearst, Kapuskasing and Sudbury districts. In southern Ontario, the most severe damage was recorded in Algonquin Region. Young, open-grown white spruce sustained up to 90% defoliation in a number of areas in Perry Township, Bracebridge District, and in Minden and Somerville townships, Minden District. High population levels were also recorded in a 3-ha, 1.5-m white spruce plantation in Eldon Township, Lindsay District, where 48% of the trees were infested; defoliation averaged 12%, although some individual trees sustained 100% defoliation and 1% mortality was recorded. A light infestation was reported in a 2-ha white spruce plantation in Mayo Township, Bancroft District.

Early Aspen Leafcurler, *Pseudexentera oregonana* (Wlsm.)

Heavy infestations that occurred in northern Hearst District in 1989 recurred in 1990. It was not possible, however, to define the boundaries of these infestations, as trembling aspen stands in this area were infested with huge numbers of forest tent caterpillars. Further east, new pockets of heavy infestation were mapped in the Iroquois Falls-Matheson area of the Cochrane and Kirkland Lake districts, where approximately 23,270 ha of trembling aspen stands were affected. The largest infestation covered 21,000 ha in the area between Montrock in Cochrane District and Watabeag in Kirkland Lake District. Six smaller pockets of damage, ranging from 160 to 700 ha in size, were mapped east of Matheson between Painkiller Lake and Lavaflow Mountain. Two smaller pockets of damage, 170 and 180 ha in size, were recorded on the western side of Frederick House Lake and along the Frederick House River in Little Township, Timmins District. Light infestations by this pest were also reported at Lerome Lake, Atikokan District, and in the Red Lake area, Red Lake District, but these were also masked by heavy infestations by the forest tent caterpillar.

Other Noteworthy Insects

A new distribution record for the satin moth (*Leucoma salicis* [L.]) was reported from Tosorontio Township, Huronia District, where a small group of European white poplar (*Populus alba* L.) sustained 80% defoliation. The insect also caused 80% defoliation on 20-m eastern cottonwood (*P. deltoides* Bartr.) trees at one location in Elizabethtown Township, Brockville District.

A new record of the beech scale (*Cryptococcus fagisuga* Linding.) was reported from Tiny Township, Huronia District.

The pine needle sheathminer (*Zelleria haimbachi* Bsk.) caused 50 to 75% defoliation on the new growth of jack pine at Hiawatha Park, near the city of Sault Ste. Marie. Light damage also occurred on roadside jack pine trees in Sagard Township, Blind River District.

Medium populations of the spruce coneworm (*Dioryctria reniculelloides* Mut. & Mun.) were found feeding in conjunction with high population levels of spruce budworm near Cox Lake, Nipigon District.

Heavy infestations of the pine bark adelgid (*Pineus strobi* [Htg.]) occurred on white pine at numerous locations in Eastern Region. High population levels also occurred on 3-0 white pine nursery stock at the St. Williams Tree Nursery, Simcoe District, and a medium infestation was reported on 4-m planted white pine at Kettle Lakes Provincial Park, Timmins District.

A new distribution record for the birch edgeminer (*Scolioneura betuleti* Klug.) was reported on European birch (*Betula pendula* Roth) in the city of Kingston, Napanee District, where several ornamental trees had 90% of their foliage attacked.

The spiny ash sawfly (*Eupareophora parca* [Cress.]) caused 25 to 50% defoliation of black ash (*Fraxinus nigra* Marsh.) at single locations in Birch and Carew townships, Chapleau District. Low population levels were present in black ash stands in a number of other areas in the Chapleau and Gogama districts and at one location in Temagami District.

Infestations by the black army cutworm (*Actebia fennica* [Tausch.]) and the black cutworm (*Agrotis ipsilon* [Hufn.]) were reported at the Thunder Bay Forest Tree Nursery, and were promptly eliminated by chemical control. A single black army cutworm larva was found at one prescribed burn location in Legge Township, Hearst District.

Heavy infestations by the aspen leaf mite (*Aceria* sp. nr. *dispar* [Nal.]) caused numerous galls in trembling aspen stands in the city of Sault Ste. Marie, along the Bolton Lake Road in Gladstone Township, Blind River District, and on shoreline trees at Dog Lake, West Township, Wawa District.

Numerous larvae of the strawberry root weevil (*Otiorhynchus ovatus* [L.]) were found on the roots of 2-0 white spruce seedlings during lifting at the Thunder Bay Forest Tree Nursery. Little actual feeding damage was evident.

A thrips (*Gnophothrips* sp.) caused severe browning to the upper portions of Scots pine Christmas trees in a plantation in Edwardsburgh Township, Brockville District.

High population levels of the larger boxelder leafroller (*Archips negundana* [Dyar]) caused severe defoliation of ornamental Manitoba maple in the city of Sudbury. Similar damage to Manitoba maple was caused by the boxelder leafroller (*Caloptilia negundella* [Cham.]) in the city of Thunder Bay and in nearby Paipoonge Township.

Increased populations of the pine spittlebug (*Aphrophora cribrata* [Wlk.]) were reported, with numerous infestations in the Chapleau, Wawa, Terrace Bay, Geraldton, Hearst, Kapuskasing and Cochrane districts.

TREE DISEASES

Armillaria Root Rot, *Armillaria ostoyae* (Romagn.) Herink

This disease is widespread in young coniferous stands throughout the province. Although infections were reported in many areas on a wide variety of hosts, the level of attack was usually less than 1%. Exceptions to this trend occurred in Kirkwood Township, Blind River District, where 5% current mortality was recorded in a 4-ha plantation of 2.6-m jack pine. Mortality levels of 3% were recorded in young jack pine stands in Horwood and Ivy townships, Chapleau District.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

European Race: Intensive surveys for the detection of the European race of this disease were continued in southern Ontario in 1989. Aerial surveys followed up by ground checks of suspect stands and close scrutiny of selected red pine stands are carried out each year. In 1990 the program was extended to southern North Bay District, as this area is relatively close to infected stands in Parry Sound District. Confirmed collections of the European race have been made in McMurrich and Ryerson townships, Parry Sound District, and in Mayo Township, Bancroft District. All collections were in the vicinity of previous finds and do not represent any spread of the disease. A confirmed collection from Stephenson Township, Bracebridge District, is a new record in this township but does not represent a spread of any significant distance from previous finds.

North American Race: Reports of the North American race were received from a few areas in northern Ontario. The most severe damage occurred in Reaney Township, Chapleau District, where 58% of the trees in a 2-ha frost pocket within a 200-ha jack pine plantation were dead, with an additional 20% infected. Small numbers of trees were also infected throughout the remainder of the plantation. Pockets of damage were also reported in jack pine plantations in Warden Township and in red pine plantations in Chamberlain Township, Kirkland Lake District. A 3-ha stand of 1.8-m red pine in Olrig Township, North Bay District, sustained an infection level of 23%; however, race determination has not yet been made for this finding.

Ink Spot of Aspen, *Ciborinia whetzelii* (Seaver) Seaver

Infections by ink spot disease were common in immature aspen (*Populus* spp.) stands in Thunder Bay District. The largest area of damage was in a 5-ha stand in Pardee Township, where foliar damage of 30% was recorded. Foliar damage of approximately 30% was also apparent in smaller aspen stands in Sackville, Paipoonge, Oliver and Ware townships. Low levels of damage were also reported in Alderson Township, Hearst District, Opasatika Township, Kapuskasing District, and Brackin Township, Chapleau District.

Pine Needle Rust, *Coleosporium asterum* (Dietel) Sydow

This disease was widely distributed in jack pine stands in northern Ontario. It was most severe in Chapleau District, where evaluations at 13 locations showed infection levels ranging from 12 to 95% (avg. 58%) and accompanying foliar damage levels ranging from 7 to 25% (avg. 15%). Although infection levels were quite high in a number of other areas, actual foliar damage in most cases was less than 10%. Some exceptions were as follows: in Chelsea Township, Hearst District, 99% infection with 16% foliar damage; near Flynne Creek, Geraldton District, 100% infection and 15% foliar damage; in Macmurchy Township, Gogama District, 99% infection with 12% foliar damage; and

along the Namakan River, Atikokan District, 20% infection with 30% foliar damage.

Reports of the disease were less common in southern Ontario. A light infection occurred in a red pine plantation in Bexley Township, Lindsay District, although foliar damage on infected trees averaged 60%. The disease was also reported in single plantations in the Bracebridge and Brockville districts.

Sweetfern Blister Rust, *Cronartium comptoniae* Arthur

This stem-canker disease of jack pine was present in many stands in Northern Region, usually at low infection levels (<2%). An exception occurred in Hutcheon Township, Chapleau District, where 8% of 1.5-m jack pine were infected. As well, infection levels of 5% were recorded in a plantation in de Gaulle Township, Chapleau District, and in Invergarry and Vrooman townships, Gogama District.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

This disease was widespread in jack pine stands in Northern Region, particularly in the Chapleau and Gogama districts. Evaluations in these two districts revealed a range of infection levels from 16 to 99% (avg. 40%) and foliar damage ranging from 7 to 40% (avg. 27%). The disease was also reported, usually at low infection levels, in the Timmins, Kirkland Lake, Hearst, Cochrane, Temagami and Nipigon districts. Foliar damage in all cases was less than 10%.

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

This disease caused varying degrees of damage in young jack pine stands in northern Ontario. The most severe damage occurred in a 2.6-m, 16-ha stand in Lane Township, Blind River District, where 61% of the trees were infected, 39% severely. Severe damage also occurred in Chapleau District, where young stands in de Gaulle and Neelands townships had 46 and 56% infection levels and 21 and 44% severe damage levels, respectively. Infection levels ranging from 1 to 37% were reported from numerous other areas in the Chapleau, Gogama, Timmins, Kirkland Lake, Atikokan, Thunder Bay, Hearst, Cochrane, Terrace Bay, Geraldton, Wawa, Sioux Lookout and Ignace districts.

Diplodia Tip Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

This disease continues to cause tree mortality in older Scots pine plantations in a number of areas in eastern Maple District. Severe shoot damage was evident in part of a Scots pine Christmas tree plantation in North Walsingham Township, Simcoe District. Severe branch damage and occasional

tree mortality occurred on ornamental Austrian pine (*Pinus nigra* Arnold), red pine and Scots pine in the Huronia, Maple, Cambridge, Chatham, Niagara, Simcoe, Napanee, Carleton Place and Timmins districts.

Infection levels averaging 15.9% were recorded in three black spruce (*Picea mariana* [Mill.] B.S.P.) seed orchards in Sioux Lookout District, where the disease caused serious damage in 1989. Infection levels averaged 1.7% in two black spruce seed orchards in Ignace District.

Other Noteworthy Diseases

White pine blister rust (*Cronartium ribicola* J.C. Fischer) was reported from a number of districts, with infection levels ranging from 2 to 30%.

A needle cast (*Davisomycella fragilis* Darker) damaged 50% of the foliage on 8-m jack pine in a natural stand in Fauquier Township, Hearst District.

A larch-willow rust (*Melampsora paradoxa* Dietel & Holway) caused approximately 2% foliar damage on 100% of the trees in a 2-ha tamarack experimental plot at Wally Creek in Dempsey Township, Cochrane District.

An increased incidence of Dutch elm disease (*Ceratocystis ulmi* [Buism.] C. Moreau) was reported in Maple District, particularly in the Rogers Reservoir conservation area in East Gwillimbury Township, where 12 8-m trees were infected or dead.

The spruce cone rust *Chrysomyxa pirolata* [Körn.] Winter) was found on 2% of the trees in a 280-ha plantation in Chelsea Township, Hearst District.

Comandra blister rust (*Cronartium comandrae* Peck) was found infecting 2% of the trees in a jack pine seed orchard in Paipoonge Township, Thunder Bay District.

A needle cast (*Lophodermium nitens* Darker) caused 20% foliar damage in a 0.5-ha plantation in Lane Township, Blind River District.

A gray mould (*Botrytis cinerea* Pers.:Fr.) was found at high incidence and low damage levels on black spruce seedlings supplied by private growers at the Dryden Forest Tree Nursery, Dryden District.

A needle blight (*Rhizosphaera kalkhoffii* Bubák) caused 40% foliar damage on 10-m black spruce at the Bonner Centre in Fauquier Township, Kapuskasing District. It was also reported causing 35% foliar damage to balsam fir regeneration over a 20-ha area in Reaney Township, Chapleau District.

Shoot blight of aspen (*Venturia macularis* [Fr.] E. Müller & v. Arx.) caused varying but generally low damage to young trembling aspen in a number of areas in the Northern and Northeastern regions.

Heavy infections by sycamore anthracnose (*Apiognomonia veneta* [Sacc. & Speg.] Höhnel) were reported on ornamental sycamore (*Platanus* spp.) trees and sycamore growing in lowlying areas in the Niagara, Simcoe, Chatham and Aylmer districts.

A single, severe infection by the chestnut blight (*Cryphonectria parasitica* [Murrill] Barr) was reported on American chestnut (*Castanea dentata* [Marsh.] Borkh.) in Bayham Township, Aylmer District.

ABIOTIC CONDITIONS

Blowdown

Scattered patches of blown-down trees, totaling about 200 ha, were mapped in Frey, Sewell and Kenogaming townships in western Timmins District. Black spruce, tamarack, trembling aspen and white birch were the species most commonly affected. Similar small pockets of blown-down timber, mainly black spruce, were mapped in Guilfoyle and Tucker townships, Kapuskasing District and Agate and Swartman townships, Cochrane District.

High winds severely damaged the developing foliage of sugar maple, silver maple (*Acer saccharinum* L.) and some other hardwoods at a number of areas in Southwestern Region. The most severe damage was recorded in North Easthope Township, Wingham District, where 100% of the trees examined were affected, with foliar damage of approximately 70%.

Snow and Ice Damage

Late-spring storms caused widespread damage in Northern Region and in Temagami District of Northeastern Region. Heavy snow and ice loading resulted in broken branches and tops of larger trees and severely bent stems of smaller trees of most species in southern Hearst District and in scattered areas in the Cochrane and Kapuskasing districts. Red pine and jack pine were severely and permanently bent at a number of areas in the Timmins, Kirkland Lake and Temagami districts. Ice and snow loading is also thought to have caused low levels of leader damage to white spruce seedlings at the Swastika Forest Tree Nursery in Kirkland Lake District and 6% leader damage in a 20-ha jack pine family-test area in Evelyn Township, Timmins District.

Ice storms caused severe damage in the form of broken branches to shoreline willow (*Salix* spp.) and poplar (*Populus* spp.) along the northern shore of Lake Erie in the Chatham, Aylmer, Simcoe and Niagara districts.

Frost

Late-spring frosts caused widespread damage to the foliage of deciduous species along the northern shore of Lake Erie and the eastern shore of Lake Huron in Southwestern Region. Stands up to 15 km inland from the lakes were affected, with the most severe damage on trees and stands with a northwestern exposure. Silver and sugar maple were the species most commonly affected, with ash (*Fraxinus* spp.) and beech (*Fagus* spp.) also sustaining some damage. Similar foliar damage to hardwoods was observed in many parts of the Bracebridge, Minden and Parry Sound districts of Algonquin Region and Lindsay District of Central Region. Discolored foliage averaged 60% in some areas, with accompanying whole-leaf mortality of 10%. Frost caused low levels of damage to red oak, silver maple and white spruce, but killed 15 and 13% of the terminal buds of Norway spruce (*Picea abies* [L.] Karst.) in two compartments at the Orono Forest Tree Nursery. Frost caused discoloration and some curling and stunting of sugar maple foliage in the northern Cambridge District and south-central Owen Sound District.

Frost damage was widespread at generally low levels in northern Ontario on white spruce, balsam fir and, less often, on black spruce, jack pine and trembling aspen. In many instances, a high percentage of trees was affected but actual foliar damage was usually 5% or less. An exception to this trend occurred in Street Township, Sudbury District, where 50% shoot damage was recorded on 2-m white spruce in a 2-ha area. As well, 12% shoot damage was recorded on 5% of the white spruce in the Mattawin seed orchard, 20% shoot damage occurred in a black spruce seed orchard on the Grew River Road, and 35% shoot damage occurred in a black spruce seed orchard at Rowlandson Lake, all in Thunder Bay District. In Sioux Lookout District, 25% shoot damage was recorded on 82% of the trees in a white spruce seed orchard at Bawlb Lake and 15% shoot damage occurred on 85% of the trees in a white spruce seed orchard in Dawe Township, Ignace District.

Winter Drying

This condition is caused by unusually warm weather in winter and early spring, which causes moisture loss from the foliage of conifers that cannot be replaced by frozen root systems. In most cases, damage is limited to the old foliage, which turns brown and falls off, to be replaced by the new growth. In severe instances, however, bud death and occasionally branch and whole-tree mortality may occur.

The condition was prevalent in a number of areas in the Blind River, Pembroke, and Thunder Bay districts and in eastern Kirkland Lake District. It was also reported in a few areas in the Timmins, Temagami, Espanola, North Bay and Atikokan districts, but damage levels in these districts were mostly quite low. Possibly the most severe damage occurred in an 8-ha red pine plantation in Head Township, Pembroke District, where 100% of the trees averaged 38% foliar damage. The same foliar damage level was recorded in a small pitch pine (*Pinus rigida* Mill.) plantation in Parkinson Township, Blind River

District, where 85% of the trees were affected. In Thunder Bay District, winter drying was very evident on white spruce transplant stock at the Thunder Bay Forest Tree Nursery; however, in most cases buds were not damaged and the tree recovered with the new season's growth.

Ash Decline

This condition was particularly evident in a number of areas in Eastern Region in 1990. The most severe cases occurred in Napanee District, where a 5-ha white ash (*Fraxinus americana* L.) stand in Camden Township had 100% of the trees affected, 20% severely, with a 2% mortality rate. In Thurlow Township, 90% of the trees in a 2-ha stand were damaged, 10% severely, and 2% were dead. Lower levels of damage were recorded in several other areas.

Salt Damage

Salt damage occurred in varying degrees on trees planted adjacent to roadsides in many areas. As usual, trees planted in highly salted areas along major highways, on hills and at busy intersections sustained the most damage.